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(54) **Projection type image display apparatus.**

(57) A projection type image display apparatus using a light modulation image display device as a light valve varies the voltage of a video signal so as to correct the nonuniformity of luminance of the optical device so that an image uniform in brightness and color even in peripheral parts can be displayed on a projection screen.

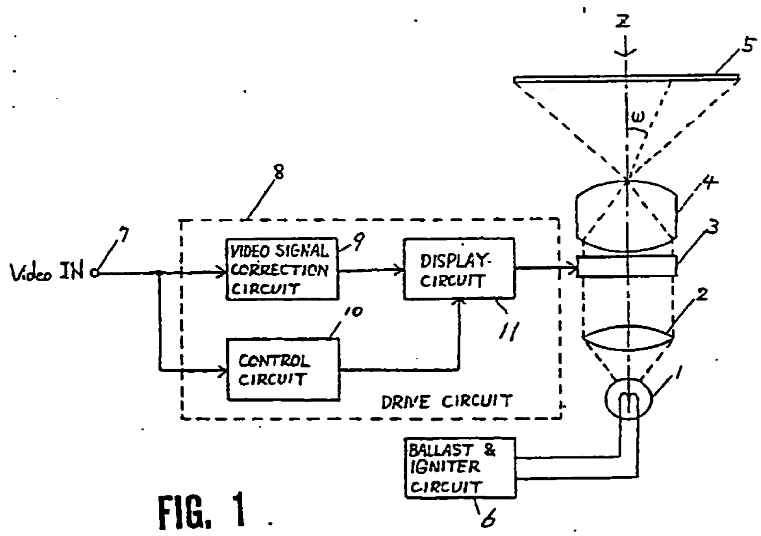

FIG. 1

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The present invention relates to a projection type image display apparatus using a light modulation image display device as represented by a liquid crystal display device as a light valve.

For image display on a wide screen, hitherto, a method of forming an optical image corresponding to a video signal as change of optical characteristic on a relatively small light valve, illuminating this optical image with illuminating light and magnifying and projecting on a screen by a projection lens is widely known. In this sort of projection type image display apparatus, the resolution of the projected image is determined by the resolution of the light valve, and when the light source is intensified, the light output becomes larger, and therefore by using a light valve of high resolution, a projection type image display apparatus of large light output and high resolution may be realized even if the display area is small. Recently, a method of using a liquid crystal display device as the light valve is noticed. For example, Morozumi et al. proposed, in "LCD Full-Color Video Projector," SID 86 Digest, p. 375, a method of obtaining a full-color projected image by using three liquid crystal display devices.

The structure of a conventional example of projection type image display device using such liquid crystal display device as the light valve is described below. The light released from the lamp is converted into a nearly parallel light by a focusing optical display device, and passes through the liquid crystal display device and enters the projection lens. In the liquid crystal display device, an optical image corresponding to a video signal obtained from an image display circuit is formed as change in the transmissivity, and this optical image is projected on the screen by the projection lens. As the lamp, halogen lamp, xenon lamp, or metal halide lamp may be used.

The image display circuit comprises a video signal demodulation circuit, a common voltage generation circuit for generating a voltage to be applied to the counter-electrode of the liquid crystal display device (hereinafter called common voltage), and a video signal output circuit for inverting the polarity .of the video signal demodulated in the video signal demodulation circuit at field intervals with respect to the common voltage in order to drive the liquid crystal display device in alternating current.

In such conventional projection type image display apparatus, however, owing to the peripheral dimming characteristic of the projection lens, supposing the image angle of the projection lens to the screen to be ω, the brightness of the peripheral part as compared with the central part on the screen of the projected image is lowered in proportion to $\cos^4\omega$.

Besides, in order to correct the luminance gradient due to difference between the effective voltage of the signal applied to the upper portion of the screen of the liquid crystal display device and the effective voltage of the signal applied to the lower portion, a method of applying a correction voltage to the common electrode was proposed (the Japanese Patent Publication Sho. 62-217224).

When the liquid crystal display appearance is used in the projection type image display apparatus, however, the peripheral dimming characteristic of the projection lens is not fully corrected by the correction of the luminance gradient in the vertical direction of the screen alone.

It is hence a primary object of the invention to present a projection type image display apparatus capable of displaying an image uniform in brightness and color even in peripheral parts on a projected screen.

To achieve the above object, the invention presents a projection type image display apparatus which comprises:
a lamp,
a ballast and igniter circuit for lighting the lamp,
an image display device for modulating a light depending on a driving signal,
an optical device for guiding a light released from the lamp to the image display device and projecting a modulated light from the image display device onto a screen, and
a driving circuit for generating the driving signal depending on an input video signal, and feeding the driving signal to the image display device,
wherein the driving circuit comprises a video signal correction circuit for varying the input video signal so as to correct the nonuniformity of the luminance of the optical device, and a control circuit for controlling the rate of change of the input video signal in the video signal correction circuit.

In this constitution, even by projecting the light modulated by the video display device on the screen to generate an image, an image uniform in brightness and color even in peripheral parts can be displayed on the projection screen.

Other features and effects of the invention will be better understood and appreciated from the following detailed description of embodiments taken in conjunction with the accompanying drawings.

Fig. 1 is a block diagram of an essential part of a projection type image display apparatus in a first embodiment of the invention,

Fig. 2 is a diagram showing a relation of illumination distribution and driving signal of projected image of the first embodiment,

Fig. 3 is a driving circuit block diagram of an image display device of the first embodiment,

Fig. 4 is a table of digital data to be stored in a read-only memory of the first embodiment,

Fig. 5 is a block diagram of an essential part

of an active matrix type liquid crystal display device used as an example of image display device,

Fig. 6 is a block diagram of an essential part of a projection type image display apparatus in a second embodiment of the invention,

Fig. 7 is a diagram showing a relation of illumination distribution and driving signal of projected image of the second embodiment, and

Fig. 8 is a driving circuit block diagram of an image display device of the second embodiment.

Referring now to the drawings, some of the preferred embodiments of the invention are described in detail below.

Fig. 1 is a block diagram showing a structure of an essential part in a first embodiment of the invention.

In Fig. 1, the light generated from a lamp 1 driven by a ballast and igniter circuit 6 is converted into a nearly parallel light in a focusing optical device 2, and passes through an image display device 3 and enters a projection lens 4. The image display device 3 is an active matrix type liquid crystal display device, in which, in response to an output driving signal of a drive circuit 8, an optical image corresponding to a video signal is formed as a change in the transmissivity. This optical image is projected on a screen 5 by the projection lens 4. The lamp 1 is a metal vapor discharge lamp such as metal halide lamp, mercury lamp and sodium lamp. In particular, the metal halide lamp is excellent in lamp efficiency and lamp life, and its light emission spectrum is suitable for the image display device.

The video signal entering an input terminal 7 is corrected of its signal amplitude in a video signal correction circuit 9, and the image display device 3 is driven through a display circuit 11. At this time, the correction amount of the signal amplitude, that is, the rate of change of video signal voltage is controlled by a control circuit 10. The video signal correction circuit 9, display circuit 11 and control circuit 10 constitute the drive circuit 8.

In thus composed projection type image display apparatus, its operation is described below. Fig. 2 shows a relation between the illumination distribution and driving signal of projected image on the screen 5. When the image display device 3 is driven by a raster signal, the light transmissivity becomes constant in the whole display region of the image display device 3. In the imaging optical system, however, the illumination E on the screen 5 is expressed as follows, supposing the aperture factor of the projection lens to be K and the image angle of the projection lens to be ω,

$E = E_0 K \cos^4\omega$

where E_0 is the intensity of illumination on the screen 5 on the optical axis of the projection lens. Therefore, owing to the peripheral dimming characteristic of the projection lens 4, the projected image on the screen 5 is lowered in the luminance in the peripheral parts as compared with the central part. Fig. 2 (a) denotes a distribution of uniform illumination curves on the screen 5 as seen in the Z-direction in Fig. 1. For example, the intensity of illumination of the single-dot chain line A-A′ in Fig. 2 (a) is as shown in dotted line La in Fig. 2 (b), and darker in the peripheral parts. At this time, the signal voltage for driving the image display device 3 is indicated by dotted line Sa in Fig. 2 (c). Accordingly, when the signal voltage for driving the image display device 3 is designed as indicated by solid line Sb in Fig. 2 (c) so that the voltage to drive the central part may be lower than the voltage to drive the peripheral parts, the intensity of illumination on the single-dot chain line A-A′ in Fig. 2 (a) becomes uniform as indicate by solid line Lb in Fig. 2 (b). by sequentially correcting the signal voltage for driving the image display device in the vertical direction, a projected image of uniform brightness is obtained on the entire screen.

The video signal of solid line Sb in Fig. 2 (c) for driving the image display device 3 is realized by a driving circuit as shown in Fig. 3. In Fig. 3, as the video signal correction circuit 9 shown in Fig. 1 a voltage-controlled type variable amplifier 21 is used. The control circuit 10 comprises a synchronous separator circuit 22, address counters 23, 24, a clock generator 25, a read-only memory (ROM) 26, a digital-to-analog converter (D/A converter) 27, and a low pass filter (LPF) 28.

First, the video signal entering the input terminal 7 is separated into a vertical sync signal (Vsync) and a horizontal sync signal (Hsync) in the synchronous separator circuit 22. At the address counter 23, the horizontal sync (Hsync) signals are counted on the basis of the vertical sync (Vsync) signal separated in the synchronous separator circuit 22, and an address indicating the position in the vertical direction of the screen is generated and applied to the ROM 26. On the other hand, at the address counter 24, on the basis of the horizontal sync signal, the clocks locked on the horizontal sync signal generated in the clock generator 25 are counted, and an address indicating the position in the horizontal direction of the screen is generated and applied to the ROM 26. In the ROM 26, preliminarily, a table of digital data for controlling the amplification factor of the variable amplifier 21 is stored, and the digital data delivered from the address counters 23, 24 are specified. The digital data delivered from the ROM 26 are converted into an analog signal in the D/A converter 27, and this analog signal is fed into the variable amplifier 21 through the LPF 28.

As the table of the digital data considering the dimming characteristic of the projection lens 4 is

stored in the ROM 26, the input video signal is changed in the signal amplitude by the variable amplifier 21, and the corrected video signal as indicated by solid line Sb in Fig. 2 (c) is obtained. For example, as the table of the digital data to be stored in the ROM 26, a table as shown in Fig. 4 is prepared. The table shown in Fig. 4 is an example when the center of the image display device 3 is on the optical axis of the projection lens 4 on a screen with the horizontal-to-vertical ratio of 4:3.

The image display device 3 is an active matrix type liquid crystal display device as shown in Fig. 5. In Fig. 5, the liquid crystal panel 3 is a matrix liquid crystal panel having gate bus lines xi and source bus lines yj disposed in a matrix, and each picture element is composed of a thin film transistor 41 as a switching element and a liquid crystal cell 42. The gate of the thin film transistor 41 is connected to a gate bus line xi, and the source to a source bus line yj. The liquid crystal cell 42 is connected to the drain of the thin film transistor 41 and the common electrode 43. A source driving circuit 45 generates a voltage corresponding to the video signal on the source bus line yi, and a voltage is applied to the liquid crystal cell 42 by turning on the thin film transistor 41 by a scanning signal generated by a gate driving circuit 44.

Referring to Fig. 3, to operate the image display device 3 shown in Fig. 5, the corrected video signal is fed to a changeover circuit 30 of the display circuit 11, and the video signal inverted in polarity of the signal voltage by a polarity inverting circuit 29 is fed to the changeover circuit 30 of the display circuit 11. In the changeover circuit 30, by the vertical sync signal generated in the synchronous separator circuit 22, these two signals are changed over at field intervals. The signal inverted in polarity at field intervals by the changeover circuit 18 is fed into the image display device 3 through an output buffer 31. A specified voltage is applied by a common voltage generating circuit 32 to a common electrode 43 of the image display device 3.

In this way, by correcting the amplitude of the video signal in consideration of the dimming characteristic of the projection lens, an image having a uniform brightness in every part of the screen can be displayed on the projection screen.

So far is explained an example of correction for making uniform the central brightness and peripheral brightness on the projected image, but the ratio of the peripheral brightness to the central brightness may be easily and arbitrarily set by the table of digital data stored in the ROM 26.

In this foregoing description, meanwhile, an active matrix type liquid crystal display device is used as the image display device, but any other display device may be similarly employed as far as the image may be displayed as change in the optical characteristic by electric signals, such as electro-optical crystal display device.

Fig. 6 is a block diagram showing a structure of an essential part in a second embodiment of the invention.

In Fig. 6, the white light generated from a lamp 51 driven by the ballast and igniter circuit 66 is converted into a nearly parallel light by a focusing optical device 52, and is separated into primary color lights of red, green and blue by red-reflection dichroic mirror 53, green-reflection dichroic mirror 54, and blue-reflection dichroic mirror 55. The red, green and blue primary color lights are respectively guided to image display devices 59, 60 and 61 by corresponding field lenses 56, 57 and 58. Each one of three image display devices 59, 60, 61 is an active matrix type liquid crystal display device, and an optical image corresponding to the video image is formed as the change of the transmissivity in response to a driving signal from a drive circuit 72. The red, green and blue optical images are magnified and projected by three projection lenses 62, 63 and 64, and are synthesized into a color image on a screen 65 viewed in the Z′-direction. The optical axes of the three projection lenses 62, 63, 64 are parallel, and extension points of the optical axes of the projection lenses on the screen 65 are respectively Xr, Xg, Xb. Here, Xb is the center of the screen 65. The screen center of the image display device 60 is located on the optical axis of the projection lens 63, and the screen centers of the image display devices 59 and 61 are shifted from the optical axes of the projection lenses 62 and 64, so that the optical images formed on three image display devices 59, 60, 61 are synthesized on the screen 65.

The video signal entering an input terminal 67 is demodulated into red, green and blue primary signals (R, G, B) in a video signal demodulation circuit 68. Each primary signal is corrected of its signal amplitude by a video signal correction circuit 69, and the image display devices 59, 60, 61 are driven through a display circuit 71. At this time, the correction amount of signal amplitude, that is, the rate of change of video signal voltage is controlled by a control circuit 70. The video signal demodulation circuit 68, video signal correction circuit 69, display circuit 71 and control circuit 70 constitute the drive circuit 72.

The operation of thus composed projection type image display apparatus is explained below. Fig. 7 (b) represents an illumination characteristic in the horizontal direction B-B′ of the central part in the vertical direction of the projected image on the screen 65. When the image display devices 59, 60, 61 are driven by raster signals, the light transmissivity becomes uniform in the entire display re-

gions of the image display devices 59, 60, 61, but the projected image on the screen 65 is lowered in the illumination in the peripheral parts, with respect to the extension points Xr, Xg, Xb of the optical axes of the individual projection lenses on the screen 65 due to the peripheral dimming characteristics of the projection lenses 62, 63, 64. Therefore, the illumination characteristics Br, Bg, Bb as shown in Fig. 7 (b) are obtained. In other words, when the white balance is appropriate in Xg, the red is intense in Xr and the blue is intense in Xb. The signal voltage for driving the image display device 59 at this time is indicated by dotted line SRa in Fig. 7 (c), and the signal voltage for driving the image display device 60 is indicated by solid line SG in Fig. 7 (d), and the signal voltage for driving the image display device 61 is indicated by the broken line SBa in Fig. 7 (e). Accordingly, by designing the signal voltage for driving the image display device 59 as indicated by solid line SRb in Fig. 7 (c), that is, by setting the signal voltage for driving the left side of the screen lower than the signal voltage of driving the right side of the screen, the illumination characteristic Br in Fig. 7 (b) may be made equal to Bg. Besides, by setting the signal voltage for driving the image display device 61 as shown by solid line SBb in Fig. 7 (e), that is, the signal voltage for driving the right side of the screen lower than the signal voltage for driving the left side of the screen, the illumination characteristic Bb in Fig. 7 (b) may be made equal to Bg. In this way, by sequentially correcting the signal voltages for driving the image display devices 59, 61 in the vertical direction, a projected image free from unevenness of color can be obtained on the whole screen.

The correction of video signal as described above is realized by a circuit composition as shown in Fig. 8. In Fig. 8, look-up table memories (L.U.T. memories) 83, 84 are used in the video signal correction circuit 69 shown in Fig. 6. The control circuit 70 has address counters 87, 88 and a clock generator 89 arranged in the same composition as shown in the first embodiment in Fig. 3, and addresses indicating the position in the vertical and horizontal directions of the screen are generated. The red signal (R) and blue signal (B) demodulated in the video signal demodulation circuit 68 (in Fig. 6) are converted into digital signals by A/D converters 81, 82 respectively, and are fed as address signals to the L.U.T. memories 83, 84. Each one of the L.U.T. memories 83, 84 stores a conversion table for converting the video signal amplitude considering the dimming characteristics of the projection lense 62 or 64 beforehand. The selection of conversion tables stored in L.U.T. memories 83, 84 is effected in accordance with the image display position of the video signal on the basis of the vertical sync signal and horizontal sync signal separated. in the video signal demodulation circuit 68, and the video signal amplitude at this time. Thus, the red signal and blue signal are converted in their signal amplitudes by A/D converters 81, 82 and the L.U.T. 83, 84 memories, and converted to analog signals by the D/A converters 85, 86, and the corrected primary color signals as shown in Figs. 7 (c), (e) are obtained.

The image display devices 59, 60, 61 are active matrix liquid crystal display devices same as in the first embodiment shown in Fig. 5. To operate the image display devices 59, 60, 61, the three corrected primary color signals of red, green and blue are fed into changeover circuits 91, 95, 99 of the display circuit 71, and the polarities of the signal voltages are inverted in polary inverting circuits 90, 94, 98, and these signals are fed into the changeover circuits 91, 95, 99. The changeover circuits 91, 95, 99 change over the above two input signals at field intervals in response to the vertical sync signal separated in the video signal demodulation circuit 68. The signals inverted in polarity at field intervals by the changeover circuits 91, 95, 99 are fed into the video display circuits 59, 60, 61, respectively through output buffers 92, 96, 100. A specified voltage is applied to the common electrode of the image display devices 59, 60, 61 by common voltage generator circuits 93, 97, 101.

In this way, by correcting the amplitude of video signals in consideration of the dimming characteristics of projection lenses, an image free from uneven color can be displayed on the projection screen.

In the above explanation, the green-reflection dichroic mirror is placed in the center, but the configuration of dichroic mirrors is not specified, and by the configuration of the dichroic mirrors, the primary signal to be corrected may be selected.

In this embodiment, liquid crystal display devices are used as image display devices, but any other devices may be used, such as electro-optical crystal display devices, as far as the images may be displayed as changes in optical characteristics by electric signals.

Incidentally, the invention is not limited to the illustrated embodiments of projection type image display apparatus using light modulation image display device as light valve. A main feature of the invention lies in the correction of dimming characteristic of optical devices by video signals when projecting the optical image formed on the light modulation image display device on the screen, and many other changes and modifications may be considered aside from the embodiments described herein.

Claims

1. A projection type image display apparatus comprising:
a lamp,
a circuit for lighting the lamp,
an image display device for modulating a light depending on a driving signal,
an optical device for guiding a light generated from the lamp to the image display device and projecting a modulated light from the image display device onto a screen, and
a driving circuit for generating the driving signal depending on an input video signal, and feeding it to the image display device,
wherein the driving circuit comprises a video signal correction circuit for varying the input video signal so as to correct a nonuniformity of the luminance of the optical device, and a control circuit for controlling the rate of change of the input video signal in the video signal correction circuit.

2. A projection type image display apparatus as set forth in claim 1, wherein the image display device comprises a liquid crystal display device.

3. A projection type image display apparatus as set forth in claim 1, wherein the video signal correction circuit comprises a voltage-controlled variable amplifier, and
the control circuit comprises a voltage generator circuit for generating a specified voltage depending on a time from the horizontal or vertical sync signal.

4. A projection type image display apparatus as set forth in claim 3, wherein the control circuit comprises a read-only memory for storing data for generating the specified voltage, a digital-to-analog converter, and an address counter for determining the time from the horizontal or vertical sync signal.

5. A projection type image display apparatus as set forth in claim 1, wherein the video signal correction circuit comprises a look-up table memory having stored therein a conversion table for correcting and converting digital data of the input video signal and delivering converted data, and
the control circuit comprises an address counter for applying an address for selecting the conversion table of the look-up table memory depending on the time from the horizontal or vertical sync signal.

6. A projection type image display apparatus comprising:
a lamp,
a circuit for lighting the lamp,
three image display devices each for modulating a light depending on a driving signal,
a first optical device for guiding lights of red, green and blue components from the lamp to the three image display devices,
a second optical device for projecting lights modulated by the three image display devices on a screen to form a color image, and
a driving circuit for generating the driving signal depending on an input video signal and feeding the driving signal into the three image display devices,
wherein the driving circuit comprises a video signal correction circuit for varying the input video signal so as to correct nonuniformity of luminance of the second optical device, and a control circuit for controlling a rate of change of the input video signal in the video signal correction circuit.

7. A projection type image display apparatus as set forth in claim 6, wherein each of the image display devices comprises a liquid crystal display device.

8. A projection type image display apparatus as set forth in claim 6, wherein the second optical device comprises three projection lenses to project the lights modulated by the three image display devices on the screen, in which the optical axes of the three. projection lenses are parallel,
the video signal correction circuit comprises a voltage-controlled variable amplifier, and
the control circuit comprises a voltage generator circuit for generating a specified voltage depending on a time from the horizontal or vertical sync signal.

9. A projection type image display apparatus as set forth in claim 8, wherein the control circuit comprises a read-only memory storing data for generating the specified voltage, a digital-to-analog converter, and an address counter for determining the time from the horizontal or vertical sync signal.

10. A projection type image display apparatus as set forth in claim 8, wherein the video signal correction circuit changes the input video signal so that luminance distribution on the screen by specific two projection lenses out of the three projection lenses may be equal to a luminance distribution on the screen by the remaining projection lenses.

11. A projection type image display apparatus as set forth in claim 6, wherein the second optical device comprises three projection lenses, and projects the lights modulated by the three image display devices on the screen, in which the optical axes of three projection lenses are parallel,
the video signal correction circuit comprises a look-up table memory having stored therein a conversion table for correcting and converting digital data of the input video signal and delivering the converted data, and
the control circuit comprises an address counter for applying an address for selecting the conversion table of the look-up table memory depending on a time from the horizontal or vertical sync signal.

12. A projection type image display apparatus as set forth in claim 11, wherein the video signal

correction circuit changes the input video signal so that luminance distribution on the screen by specific two projection lenses out of the three projection lenses may be equal to a luminance distribution on the screen by the remaining projection lens.

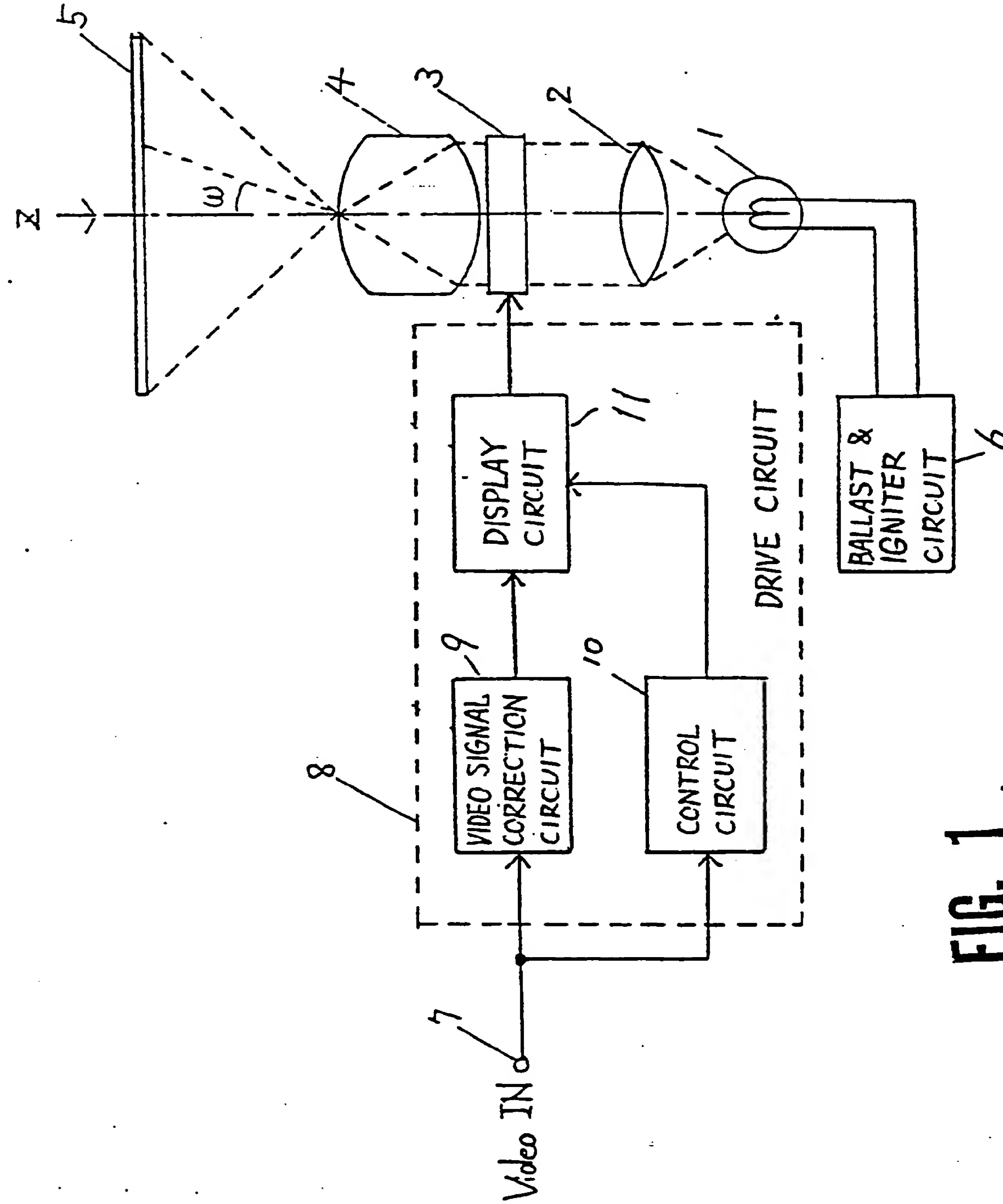
5
4
3
2
1
Z
ω
DISPLAY CIRCUIT
11
DRIVE CIRCUIT
BALLAST & IGNITER CIRCUIT
6
9
10
8
VIDEO SIGNAL CORRECTION CIRCUIT
CONTROL CIRCUIT
7
Video IN

FIG. 1

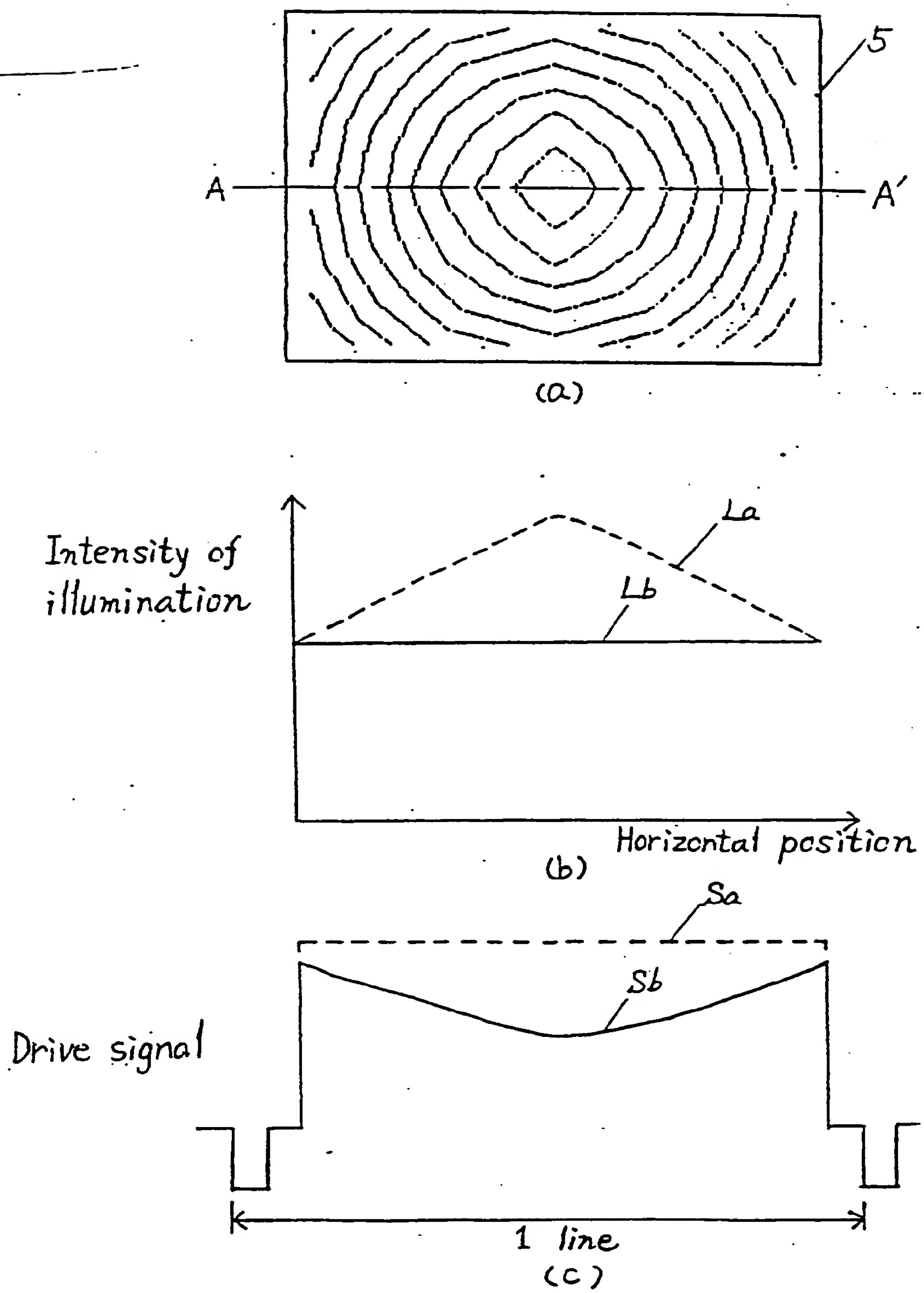
5
A
A'
(a)
Intensity of illumination
La
Lb
Horizontal position
(b)
Sa
Sb
Drive signal
1 line
(c)

FIG. 2

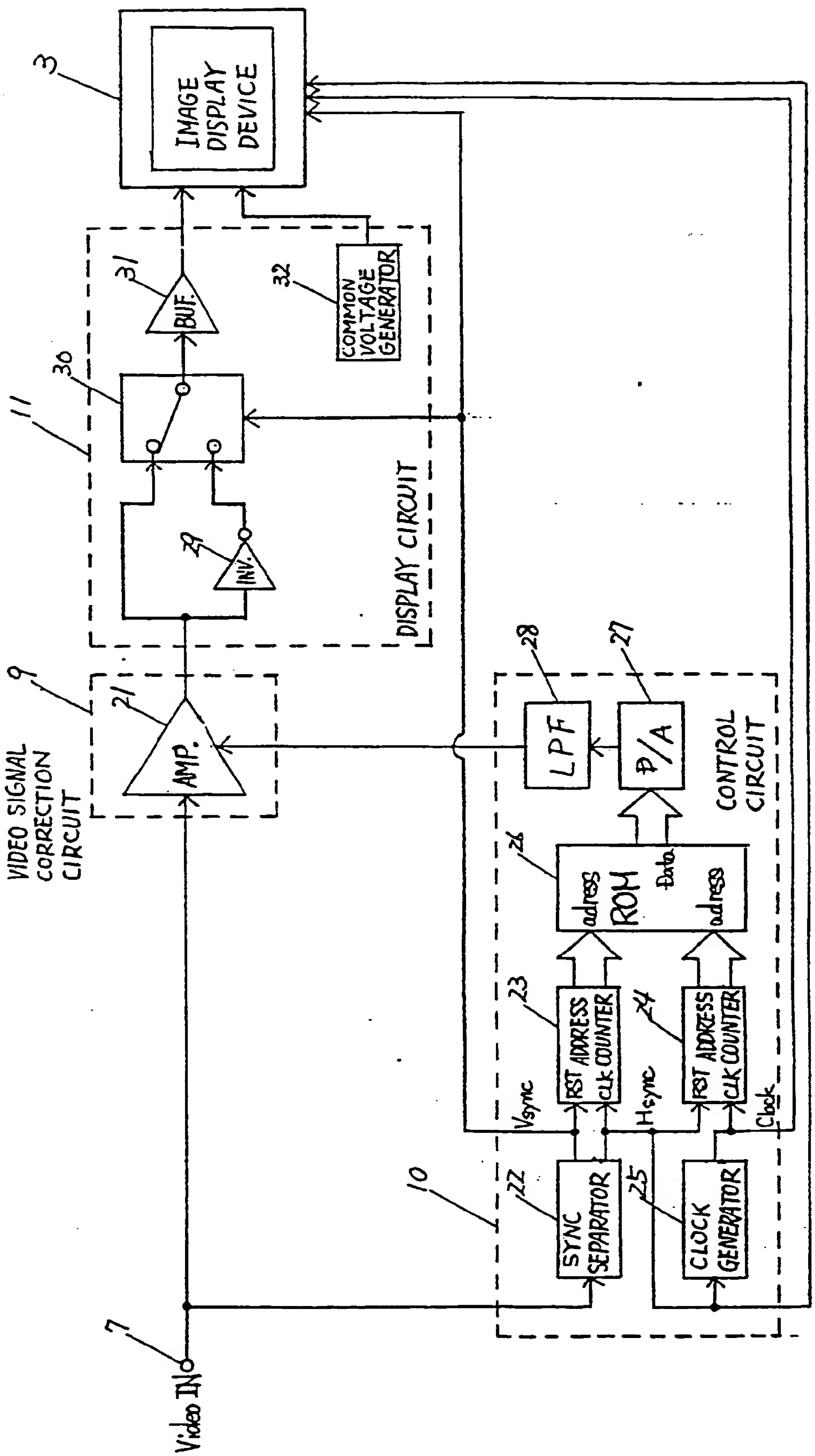
IMAGE DISPLAY DEVICE
3
BUF.
31
COMMON VOLTAGE GENERATOR
32
30
11
INV.
29
DISPLAY CIRCUIT
VIDEO SIGNAL CORRECTION CIRCUIT
9
AMP.
21
LPF
28
D/A
27
CONTROL CIRCUIT
ROM
26
adress
Data
adress
23
RST ADDRESS CLK COUNTER
24
RST ADDRESS CLK COUNTER
Vsync
Hsync
Clock
10
SYNC SEPARATOR
22
CLOCK GENERATOR
25
7
Video IN

FIG. 3

Horizontal position

Vertical position

127	122	105	65	90	65	105	122	127
124	105	89	79	76	79	89	105	124
122	65	79	75	68	75	79	65	122
115	90	76	68	66	68	76	90	115
122	65	79	75	68	75	79	65	122
124	105	89	79	76	79	89	105	124
127	122	105	65	90	65	105	122	127

FIG. 4

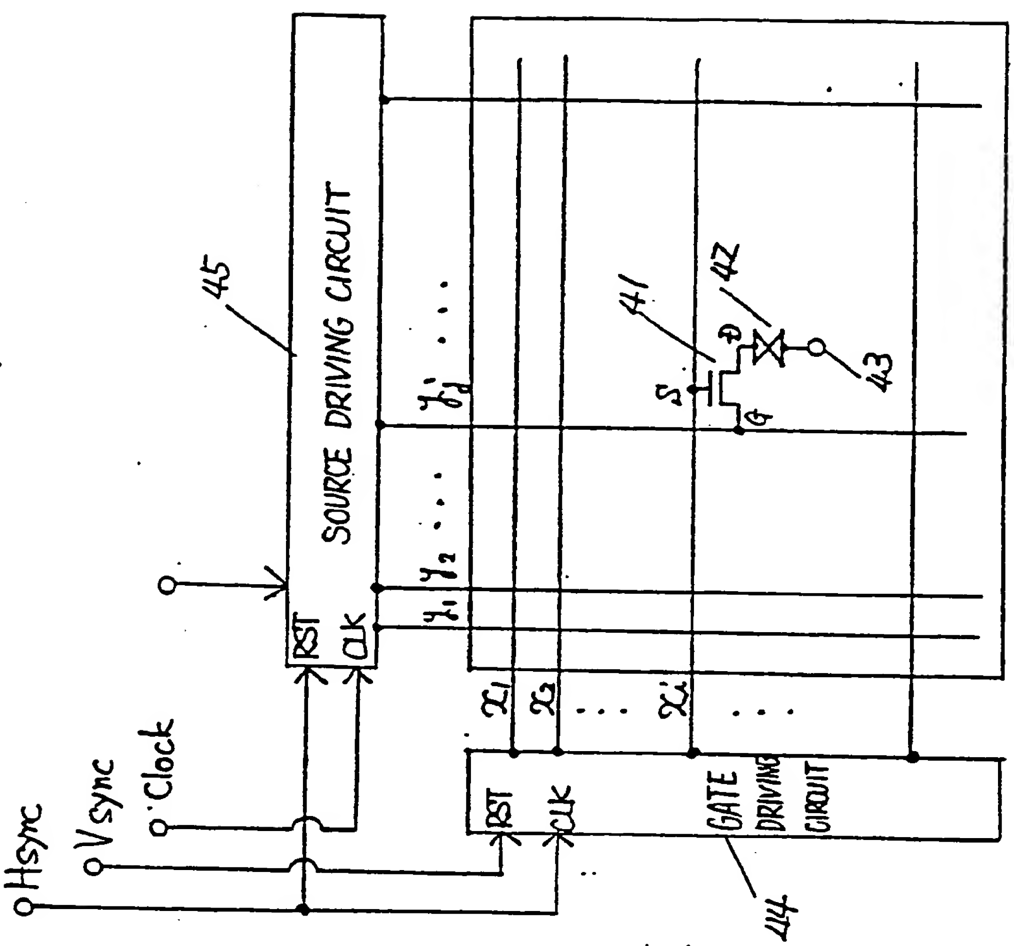
Hsync
Vsync
Clock
RST
CLK
SOURCE DRIVING CIRCUIT
45
RST
CLK
GATE DRIVING CIRCUIT
44
41
42
43
S
D
G
y_1 y_2 ... y_j ...
x_1 x_2 ... x_i ...

FIG. 5

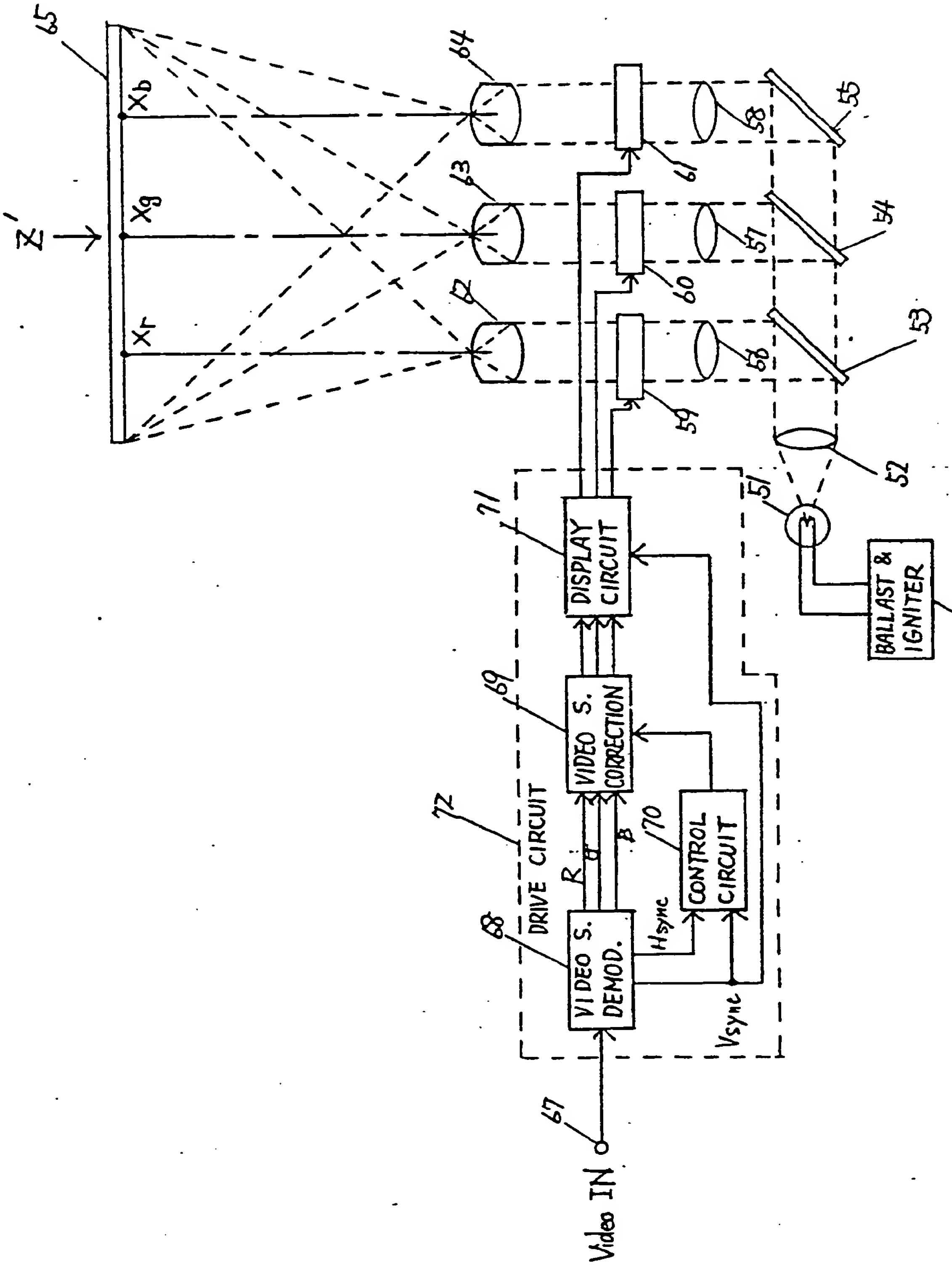
Video IN
VIDEO S. DEMOD.
VIDEO S. CORRECTION
DISPLAY CIRCUIT
CONTROL CIRCUIT
DRIVE CIRCUIT
BALLAST & IGNITER
Hsync
Vsync
R
G
B
Xr
Xg
Xb
Z'
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72

FIG. 6

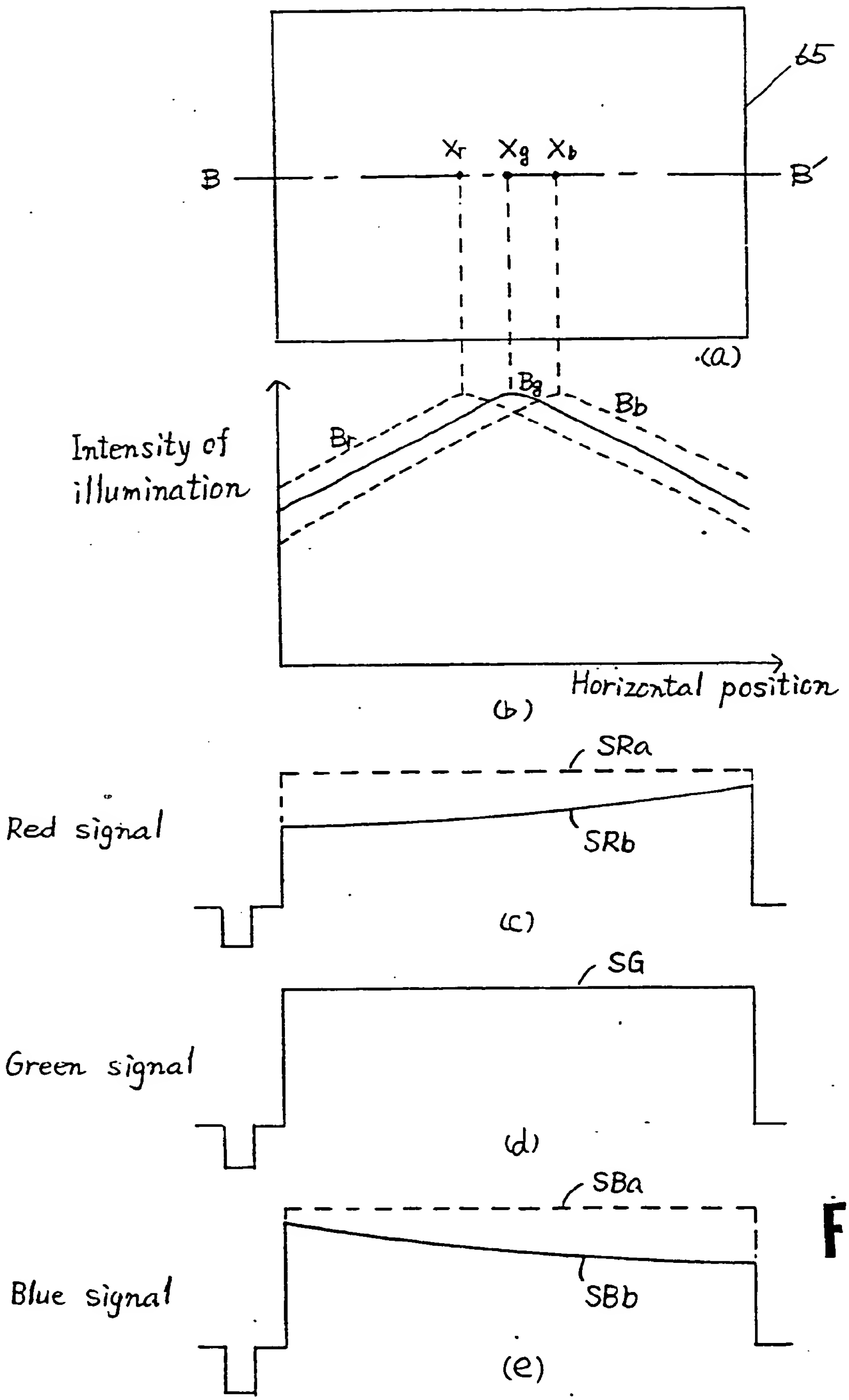
65
B
Xr
Xg
Xb
B'
(a)
Intensity of illumination
Br
Bg
Bb
Horizontal position
(b)
SRa
Red signal
SRb
(c)
SG
Green signal
(d)
SBa
Blue signal
SBb
(e)

FIG. 7

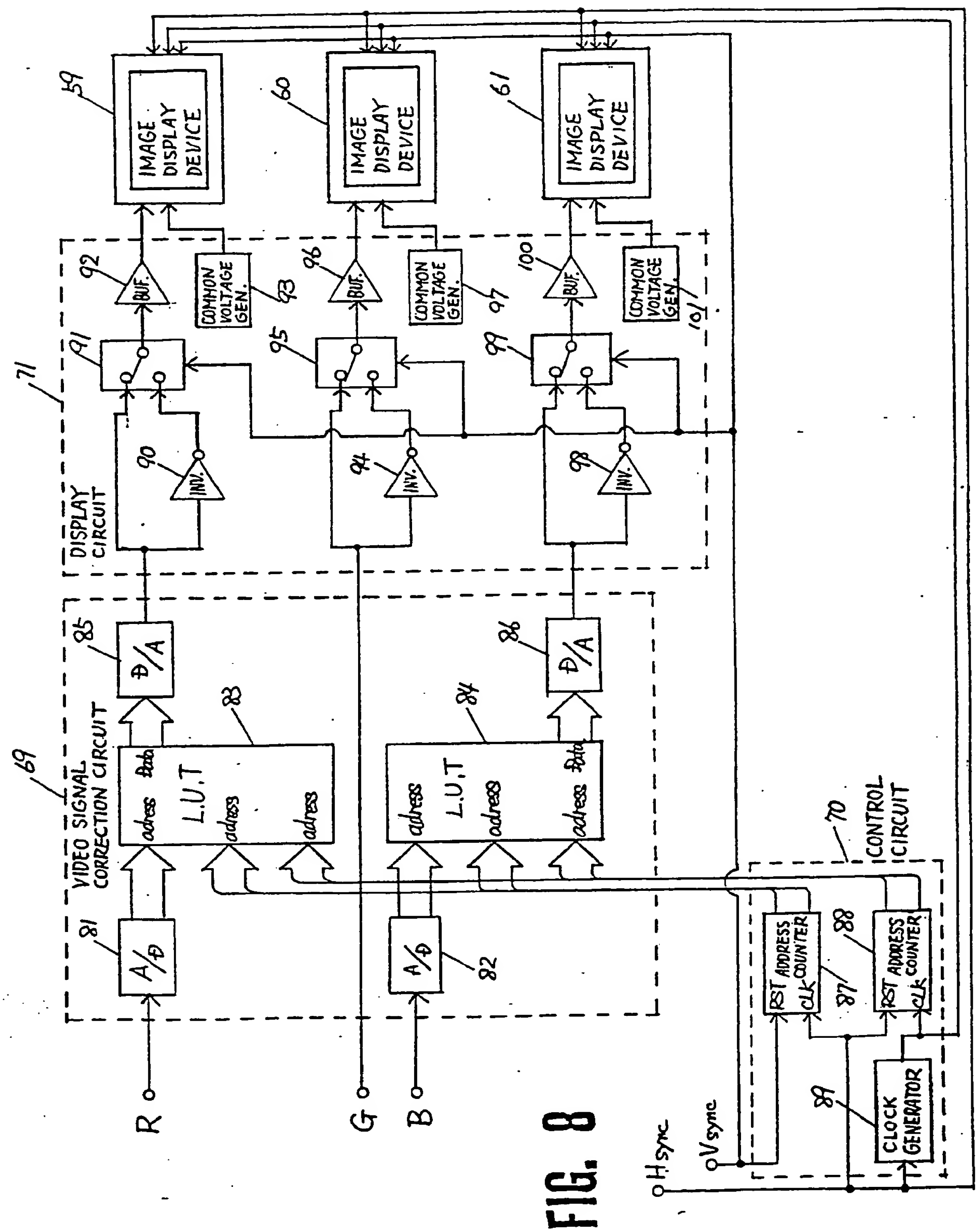
IMAGE DISPLAY DEVICE
59
60
61
BUF.
92
96
100
COMMON VOLTAGE GEN.
93
97
101
91
95
99
71
DISPLAY CIRCUIT
INV.
90
94
98
VIDEO SIGNAL CORRECTION CIRCUIT
69
D/A
85
86
L.U.T
adress
Data
83
84
A/D
81
82
R
G
B
H.sync
Vsync
CONTROL CIRCUIT
70
RST ADDRESS COUNTER CLK
87
88
CLOCK GENERATOR
89

FIG. 8

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(54) Projection type image display apparatus.

(57) A projection type image display apparatus using a light modulation image display device as a light valve varies the voltage of a video signal so as to correct the nonuniformity of luminance of the optical device so that an image uniform in brightness and color even in peripheral parts can be displayed on a projection screen.

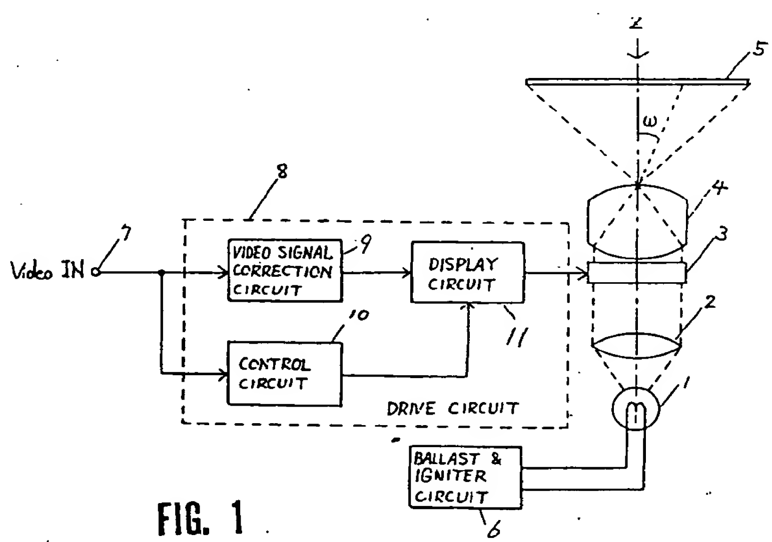

FIG. 1

EP 0 402 137 A3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 90 30 6192

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y A	PATENT ABSTRACTS OF JAPAN vol. 9, no. 19 (E-292)(1742) 25 January 1985 & JP-A-59 167 187 (PIONEER) 20 September 1984	1-3 4-6,8,10	H 04 N 9/31 H 04 N 5/74 G 02 F 1/133
Y A	PATENT ABSTRACTS OF JAPAN vol. 11, no. 126 (P-569)(2573) 21 April 1987 & JP-A-61 270 741 (TOSHIBA) 1 December 1986	1-3 6,7	
A	CA-A-1 238 410 (DESJARDINS, F.G.) * page 6, line 6 - line 13 * * page 6, line 38 - page 7, line 20 * *	6,8,10-12	
A	DE-A-2 811 715 (SANYO ELECTRIC) * claim 3; figures 1,2 * *	6,8,10-12	
A	WO-A-8 801 823 (EASTMAN KODAK) * abstract * * page 7, line 3 - line 12 * * page 11, line 13 - line 18 * * page 20, line 7 - page 21, line 30 * *	2-5,7,9, 11	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

H 04 N
G 03 B
G 02 F

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
Berlin	10 February 92	JONSSON B F

CATEGORY OF CITED DOCUMENTS

X: particularly relevant if taken alone
Y: particularly relevant if combined with another document of the same catagory
A: technological background
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